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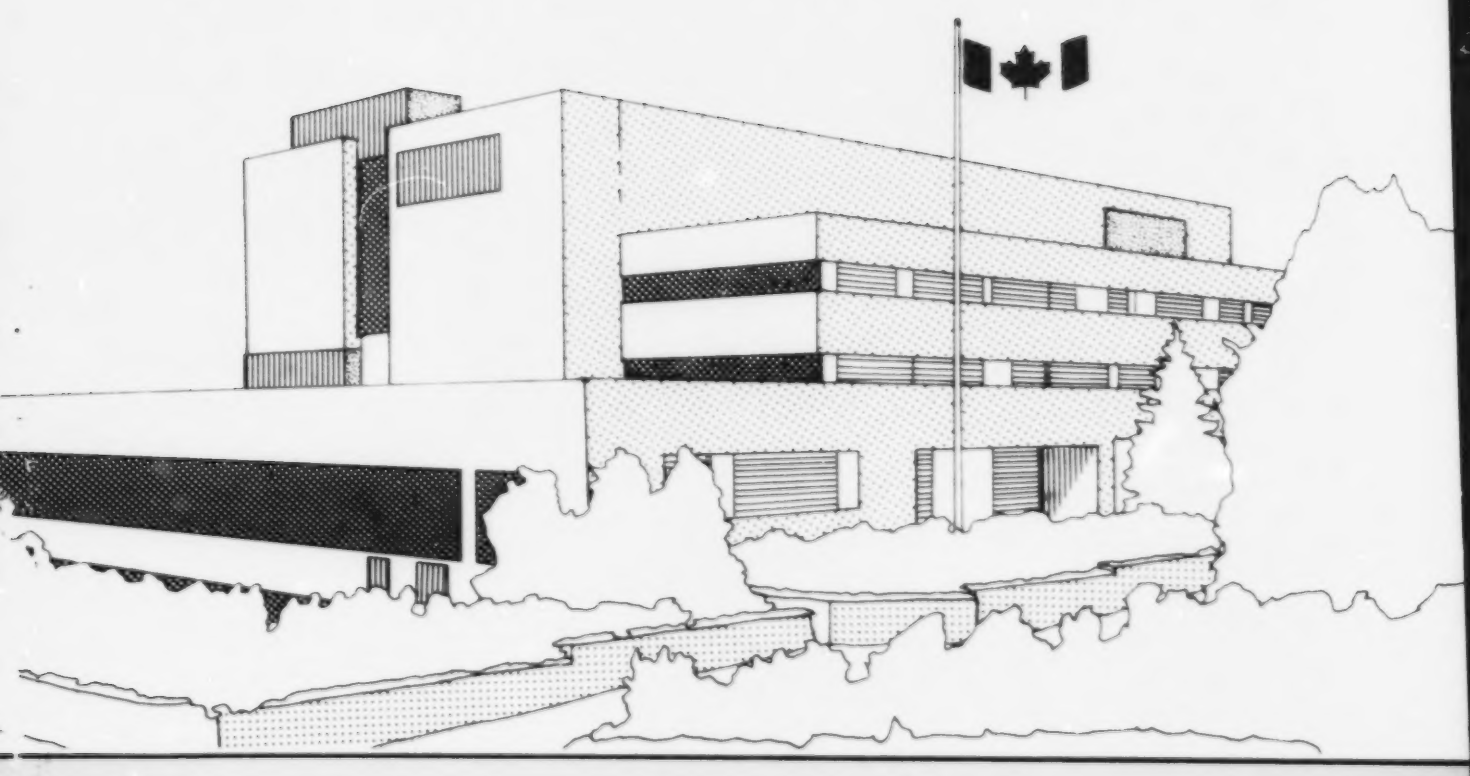
Results of forest insect and disease surveys in the NORTHERN REGION of Ontario, 1988

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

L. S. MacLeod, V. Jansens and S. Payne
Miscellaneous Report No. 82



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92-05198/

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHERN REGION OF ONTARIO 1988

(FOREST DISTRICTS: MOOSONEE, HEARST, KAPUSKASING, COCHRANE CHAPLEAU, TIMMINS, KIRKLAND LAKE AND GOGAMA)

L.S. MacLEOD, V. JANSONS and S. PAYNE

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1989

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SURVEY HIGHLIGHTS

This report documents the more important insect and disease problems that affected the forests of the Northern Region of Ontario during the 1988 field season, as determined by Forest Insect and Disease Survey (FIDS) personnel.

Several factors, including parasitism and disease, precipitated the collapse of the forest tent caterpillar outbreak in Kirkland Lake District but a new outbreak appears imminent in Hearst District. The birch leafminer continued to cause severe foliar damage in white birch stands in most districts. Monitoring of jack pine plantations showed that populations of the white pine weevil had declined slightly while damage by the eastern pine shoot borer increased. Although it did not affect commercial forest species, an extensive infestation of leaf beetles caused spectacular discoloration of willow across the region.

The most important disease in 1988 was western gall rust, which caused substantial mortality in young jack pine plantations. An unusual abiotic condition was found on spruce in several districts.

Pheromone trapping to detect the presence of gypsy moth was continued in provincial parks, and captures were made in Kirkland Lake District. Other special projects included experimental pheromone trapping for spruce budworm, detailed surveys of jack pine plantations, monitoring plots established for acid rain studies and surveys for the distribution of pinewood nematode.

The impending retirement of Walter Jansons has necessitated staff changes that have not yet been completed. The assistance and cooperation of Ontario Ministry of Natural Resources (OMNR) and woods industry personnel in all districts are gratefully acknowledged.

The same format was followed in categorizing forest pests as in the 1987 Northern Region report.

Major Insects/Diseases

capable of causing serious injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees;

(2) those that are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1988.

L.S. MacLeod
V. Jansons
S. Payne

Frontispiece

Jack pine with leader killed by white pine weevil (*Pissodes strobi* [Peck])

Control operation of clipping leaders of jack pine killed by white pine weevil (Island Lake Tree Improvement Area, Chapleau District, July 1988)

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INSECTS

Major Insects

Spruce Budworm, **Choristoneura fumiferana** (Clem.)

Spruce budworm populations continued to decline in Ontario, with a reduction in the total area of moderate-to-severe defoliation from 7,189,763 ha in 1987 to 5,224,734 ha in 1988. All defoliation was confined to the North Central and Northwestern regions (Fig. 1).

For the second consecutive year ground and aerial detection surveys failed to reveal any damage by the spruce budvorm in the Northern Region. Lov numbers of larvae were found during third-instar sampling in Hearst District, where only four and seven larvae, respectively, were recovered from sampling stations in Larkin and Frost townships. Similar sampling in Chapleau and Kirkland Lake districts yielded negative results in 1988.

Pheromone trapping was carried out on impact plots and in selected locations, but only small numbers of adults were recovered (Table 1).

A modest increase in adult moth captures was recorded in light trap operations at Remi Lake in Kapuskasing District. A similar situation was found at Chapleau, except for the nights of 8, 9 and 10 July, when 1,256 moths were trapped (Table 2), a fact that suggests a large influx of adults from an unknown source.

Egg-mass sampling was carried out at 35 locations across the region, and results indicate a lov potential for extensive damage in 1989 (Table 3).

Jack Pine Budvorm, **Choristoneura pinus pinus** Free.

Although this insect virtually disappeared from the region in 1987, detection surveys were carried out in jack pine (**Pinus banksiana** Lamb.) plantations and natural stands, particularly in areas that had been infested recently. The only budvorm found were two adult moths captured in a light trap operated at Chapleau. Egg-mass surveys were completed at 12 locations in the Chapleau, Cochrane, Hearst, Kapuskasing, Kirkland Lake and Timmins districts; as not a single egg mass was recovered, hovever, this budvorm is not expected to be a problem in 1989.

Table 1. Summary of captures of male spruce budworm moths in pheromone traps in six districts of the region, 1986-1988.

Location (Twp)	Total moths captured		
	1986	1987	1988
Chapleau District			
Peters	99	0	0
Neelands	14	0	0
Cochrane District			
St. John	7	0	2
Gogama District			
Dublin	218	0	1
Hearst District			
Larkin	63	6	1
Frost	55	29	7
Kapuskasing District			
Fauquier	8	1	1
Guilfoyle	41	0	4
Kirkland Lake District			
Maisonville	0	0	0
Pacaud	12	0	0

Table 2. Summary of captures of spruce budworm moths in light traps at two locations in the region, 1987-1988.

Location	Total moths captured	
	1987	1988
Kapuskasing District		
Remi Lake	4	87
Chapleau District		
Chapleau	4	1375

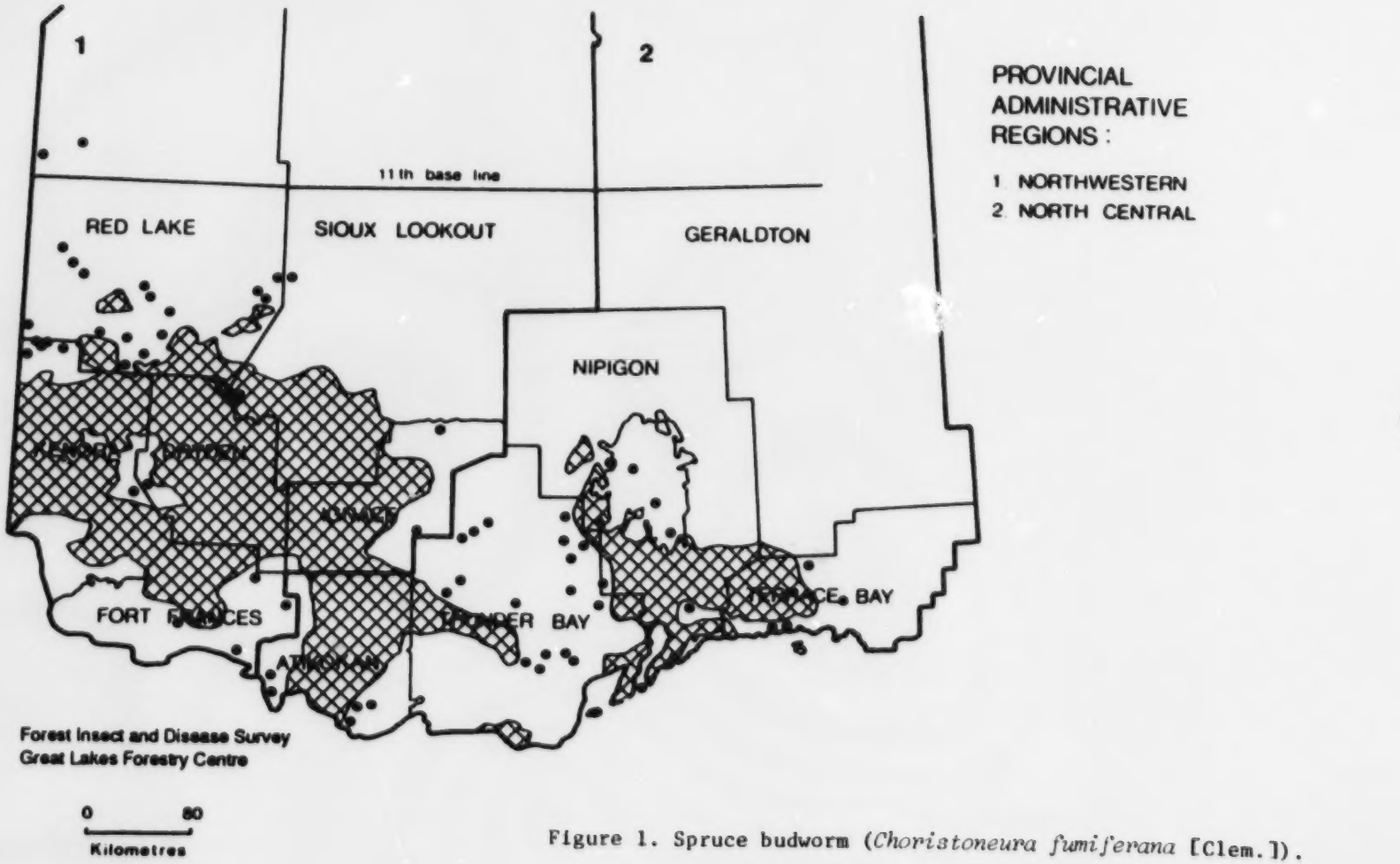


Figure 1. Spruce budworm (*Choristoneura fumiferana* [Clem.]).

Areas within which moderate-to-severe defoliation occurred in 1988 ▨ or •

Table 3. Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989.

Location	Host	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[a]	Accumulated damage[b]
Chapleau District (4 locations)					
Neelands Twp - Impact Plot	bF	0	0	0	0
	wS	0	0	0	0
Peters Twp					
- Shoals Prov. Pk	bF	0	42	L-M	+
Reaney Twp					
- Five Mile Prov. Pk	bF	0	13	L	0
Cochrane District (5 locations)					
Clute Twp - OMNR SPA[c]	wS	0	0	0	0
Fournier Twp - OMNR SPA[c]	wS	0	0	0	0
Laughton Twp	bF	0	0	0	9
Marathon Twp	bF	0	0	0	9
St. John Twp - Stand 177	bF	0	0	0	9
Gogama District (2 locations)					
Dublin Twp	bF	0	0	0	0
Garvey Twp	bF	0	26	L-M	0
Hearst District (16 locations)					
Elgie Twp	bF	0	0	0	9
Franz Twp	bF	0	0	0	9
Frost Twp					
- Nagagamisis Prov. Pk Campground	bF	0	0	0	9
- Impact Plot	bF	0	0	0	9
	wS	0	35	L-M	9
	bS	0	0	0	9
Fushimi Twp					
- Fushimi Prov. Pk	bF	0	30	L-M	9
Kohler Twp	bF	0	0	0	9

(cont'd)

Table 3. Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989 (concl.).

Location	Host	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[a]	Accumulated damage[b]
Hearst District (cont'd) (16 locations)					
Larkin Twp					
- Impact Plot	bF	0	0	0	9
	wS	0	0	0	9
	bS	0	0	0	9
Lessard Twp - Stand 341	bF	0	34	L-M	9
McEwing Twp	bF	0	0	0	9
Rogers Twp					
- Plantation 26A	bF	0	0	0	9
	wS	0	0	0	9
Studholme Twp					
- (Plantation 37)	wS	0	0	0	0
Kapuskasing District (3 locations)					
Cumming Twp	ws	0	0	0	9
Fauquier Twp					
- René Brunelle Prov. Pk	bF	0	0	0	9
Guilfoyle Twp	bF	0	0	0	9
Kirkland Lake District (3 locations)					
Maisonville Twp	bF	0	0	0	+
	bS	0	0	0	+
Pacaud Twp	bF	0	0	0	+
Timmins District (2 locations)					
Hassard Twp	bF	0	0	0	+
Thomas Twp	wS	0	0	0	3

[a] S = severe, M = moderate, L = light, 0 = nil

[b] 0 = undamaged, 3 = severe damage (60 to 80% total defoliation, 3 to 5 seasons of severe defoliation, will recover), 9 = less than 25% of stand dead (no significant defoliation, 0-25%, for several years), + = 25 to 50% of stand dead (no significant defoliation for several years

[c] SPA = Seed Production Area

Eastern Pine Shoot Borer, **Eucosma gloriola** Heinr.

Leader mortality caused by the eastern pine shoot borer was found in most jack pine plantations examined in the southern districts of the region (see photo page). In the Chapleau District, there was 15.3% leader damage at the Island Lake Tree Improvement Area, and in Copperfield Township, 10% of the leaders were killed. Quantitative sampling also indicated a general increase in population levels at several locations in the Kirkland Lake and Timmins districts (Table 4).

Table 4. Summary of leader damage by the eastern pine shoot borer in four districts of the region in 1987 and 1988 (counts based on the examination of 150 randomly selected jack pine trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Leaders killed (%) 1987	1988
Chapleau District					
Marshall	2.4	1500	25	0.0	0.7
Island Lake TIA[a]	1.3	2500	20	3.3	15.3
Copperfield	2.2	1500	68	0.0	10.0
Dalmas	2.3	1500	25	4.0	3.3
Hutcheon	1.8	1600	10	0.0	0.7
McNaught	1.4	1500	50	-	2.0
Gogama District					
Sheard	2.2	2500	200	0.0	2.0
Timmins District					
Robb	3.0	2500	100	2.0	3.3
Macklem	1.8	3500	50	3.0	8.6
Kenogaming	3.5	3500	50		0.3
Carscallen	2.5	4000	50	-	12.0
Kirkland Lake District					
Holmes	2.8	4000	50	-	9.3
Charters	1.0	4000	50	-	5.3
Chown	0.8	4000	50	-	4.0
Gross	2.1	4000	50	1.3	3.3

[a] TIA = Tree Improvement Area

Birch Leafminer, **Fenusa pusilla** (Lep.)

High populations of the birch leafminer were again found in most districts of the region. Foliage discoloration and defoliation by this introduced pest were particularly conspicuous on ornamental birches (**Betula** spp.) through urban areas, on open-grown white birch (**Betula papyrifera** Marsh.) in rural situations, and in lightly stocked forest stands.

In the towns of Chapleau and Gogama every birch tree examined was infested and 99% of the foliage was mined. Severe mining, frequently in 90% of the foliage, was common in the towns of Iroquois Falls, Cochrane, Kapuskasing and Hearst. In forested areas moderate-to-severe damage was observed on fringe trees along Highway 631 in Arnott, McEwing, Frost and Elgie townships, Hearst District, along several access roads in Kapuskasing District, and in the rural area north of Cochrane in Cochrane District.

In Kirkland Lake District, 50% foliar damage was common in pockets ranging from 0.5 to 2 ha in the Elk Lake, Earlton, Charlton, Englehart, Kirkland Lake, Larder Lake and Matachevan areas. Moderate-to-severe defoliation of ornamental trees was recorded in South Porcupine and Timmins in Timmins District.

Forest Tent Caterpillar, **Malacosoma disstria** Hbn.

Several changes occurred in the forest tent caterpillar situation in the region in 1988. In Kirkland Lake District the outbreak subsided abruptly, and although a few colonies of caterpillars were found through poplar (**Populus** spp.) stands in the spring and early summer, no defoliation was observed during ground and aerial surveys.

In the northern part of Hearst District, a new infestation totaling 9,930 ha caused moderate-to-severe defoliation on narrow bands of trembling aspen (**Populus tremuloides** Michx.) growing along the Nagagami, Kenogami, Kabinakagami and Pitukani rivers near their junction at the abandoned village of Mammamattava. As well, three small pockets totaling 620 ha were mapped in Studholme, Stoddart and Kendall townships (Fig. 2). The insect was not found in other districts of the region.

Monitoring of light traps operated at Chapleau and at Remi Lake disclosed caterpillar moth captures of 395 and 58, respectively. This represents an increase over 1987, when 72 and 12 moths were taken, respectively.

Egg-band counts in the autumn of 1988 indicate that the infestation near Hearst will increase substantially in extent and intensity in 1989 (Table 5). Inaccessibility and weather problems prevented egg surveys in the Mammamattava segment of the infestation but that infestation is also expected to expand considerably in 1989 (Fig. 3).

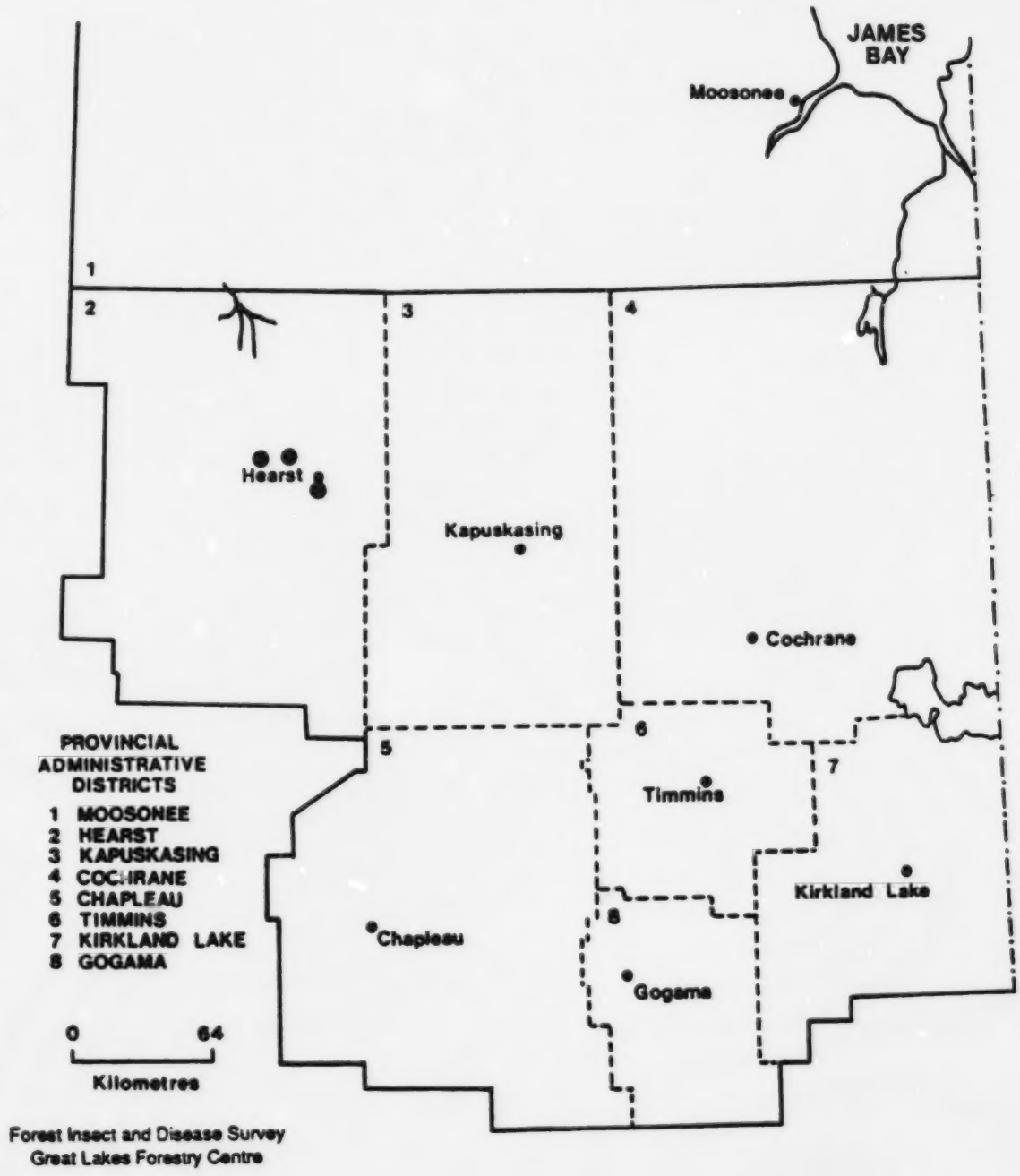


Figure 2. Forest tent caterpillar (*Malacosoma disstria* Hbn.).

Areas within which moderate-to-severe defoliation occurred in 1988

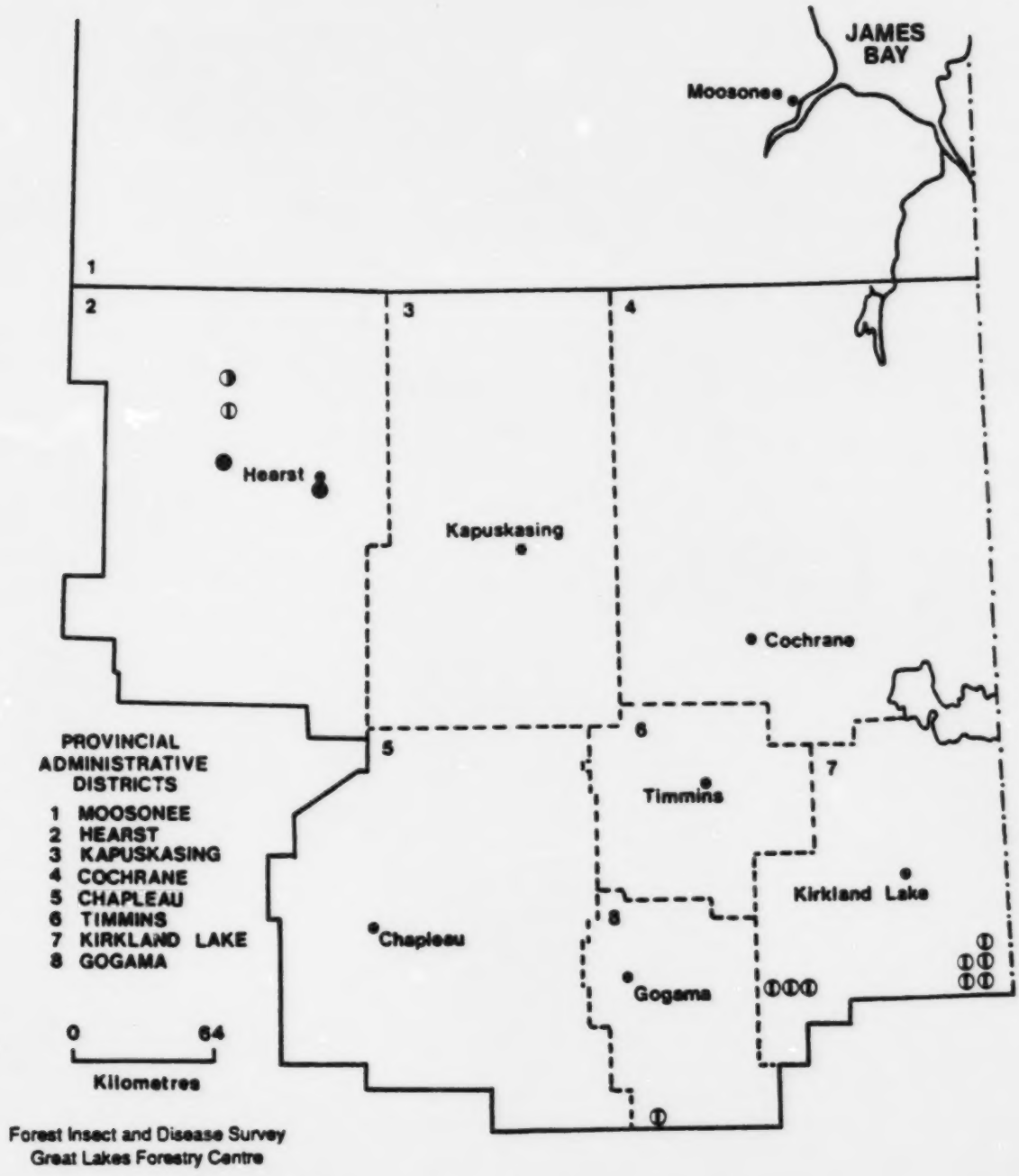


Figure 3. Forest tent caterpillar (*Malacosoma disstria* Hbn.).

Locations of egg-band samples taken in 1988 and infestation forecasts for 1989:

Negative	◑
Light	◑
Moderate to heavy	●

Table 5. Summary of forest tent caterpillar egg-band counts on trembling aspen in two districts of the region in 1988 and infestation forecasts for 1989.

Location (Twp)	Avg DBH of trees (cm)	No. of trees sampled	Total no. of egg bands	Infestation forecasts for 1989
Hearst District				
Kendall	8	2	16	heavy
Studholme	11	3	32	heavy
Rogers	16	3	0	nil
238	31	3	1	light
Kirkland Lake District				
Tyrell	16	3	0	nil
Milner	20	3	0	nil
Harley	15	3	0	nil
Casey	17	3	0	nil

Whitespotted Sawyer, **Monochamus scutellatus** (Say)

Feeding by adult sawyer beetles caused appreciable damage in one jack pine plantation in Delaney Township, Chapleau District (see photo page). Defoliation was concentrated in a 2-ha area adjacent to a jack pine log deck. In the plantation, defoliation of 99% was recorded on 1.7-m trees growing within 15 m of the log piles. Beyond 15 m the damage became progressively lighter and the total area infested did not exceed 8 ha.

Pine Sawflies, **Neodiprion maurus** Roh., **N. nanulus nanulus** Schedl., and **N. virginiana** complex

Although these sawflies did not cause serious defoliation in the region they were found more frequently than in previous years. Colonies of **Neodiprion virginiana** were common in jack pine stands throughout Chapleau, Gogama and Kirkland Lake districts. Single trees and small groups of trees along the fringes of stands sustained up to 30% defoliation at many locations, particularly in Margaret Township, Chapleau District and in Skead, Catherine, Mickle, Kimberly and Otto townships in Kirkland Lake District. Scattered colonies of **N. nanulus nanulus** were found on jack pine trees in Frost Township, Hearst District and at several points in the southern part of Kirkland Lake District. A single colony of the relatively rare sawfly **N. maurus** was found at Watabeag Lake in Nordica Township, Kirkland Lake District.

Swaine Jack Pine Sawfly, **Neodiprion swainei** Midd.

The Swaine jack pine sawfly infestation in the Elk Lake Management Unit in Kirkland Lake and Temagami districts peaked in 1981 when an area of 5,699 ha of jack pine was moderately to severely defoliated. From 1982 to 1984 a steady downward trend in population levels was recorded and the infestation subsided completely by 1985.

On 22 August 1988 a helicopter survey was made over the former infestation in the Lady Evelyn-Banks-Makobe-Alexander lakes area and light defoliation was mapped in two pockets of jack pine totaling 200 ha between Trethewey and Wolfskin lakes in the northwestern part of Trethewey Township. Subsequent ground checks revealed scattered colonies of the sawfly in jack pine plantations in Brewster, Gamble and McGiffin townships, Temagami District; in Corkill, Cane and Pacaud townships, Kirkland Lake District; in Caouette Township, Chapleau District; and in Greenwater Provincial Park, Cochrane District.

Moderate-to-severe defoliation (approximately 50%) recurred on Island 127 on the northeast arm of Lake Temagami, where a small pocket (0.2 ha) of infestation has persisted for several years. Scattered colonies of the sawfly were also found on islands and in shoreline stands at many other points on Lake Temagami.

Yellowheaded Spruce Sawfly, **Pikonema alaskensis** (Roh.)

High numbers of the yellowheaded spruce sawfly and resultant damage were reported from several districts of the region. Windbreaks, snow hedges, plantations and white spruce (**Picea glauca** [Moench] Voss) and black spruce (**Picea mariana** [Mill.] B.S.P.) trees in open-growing situations along roadsides and in old fields and cutovers sustained moderate-to-severe defoliation at many locations.

In the town of Chapleau approximately 40% of the ornamental trees experienced 10-75% defoliation. In Wakami Provincial Park defoliation was approximately 40% on 100% of the 1- to 2-m spruce trees throughout the park. Ornamental white spruce trees at the entrance to Ivanhoe Provincial Park were also defoliated, with damage ranging from 10 to 35%. In Battersby Township, Gogama District some damage occurred in a mixed pine and spruce plantation but current defoliation did not exceed 10%.

In Kirkland Lake District the sawfly was found infesting one-year-old black spruce trees in the OMNR seed orchard in Chamberlain Township. Windbreaks at the Swastika Tree Nursery were sprayed to control defoliation, and spraying was also carried out by the Ontario Ministry of Transportation and Communications on snow hedges along Highway 11 between New Liskeard and Englehart. The most severe damage in the district was recorded in the Ramore-Shillington-Matheson-Monteith area, where defoliation ranged from 10 to 80%.

Moderate-to-severe defoliation on trees averaging 2 m in open-growing situations occurred at numerous points in Timmins, Cochrane and Kapuskasing districts. Defoliation ranged from 10 to 90% on black and white spruce in Mowbray and Hovells townships, Kapuskasing District and on 2.5-m white spruce trees at several points in Fournier Township, Cochrane District. Incidence and damage levels decreased on 1- to 2-m white spruce trees in René Brunelle Provincial Park at Remi Lake in Kapuskasing District, and little damage resulted.

White Pine Weevil, **Pissodes strobi** (Peck)

Relatively high leader mortality in some jack pine plantations in several districts of the region, together with concern expressed by woods personnel of the E.B. Eddy Company, prompted a detailed survey to assess damage by this pest in 1988. In April, FIDS crews working from E.B. Eddy's Camp 303 conducted surveys of jack pine plantations in Invergarry and Vrooman townships, Gogama District. Forty semi-permanent plots were established and damage incurred by the weevil and other agents in 1987 was recorded. These plots were retallied in the autumn of 1988 to provide a comparison of damage by the various pests (Table 6).

Results of quantitative sampling for the white pine weevil in other plantations of the region are shown in Table 7 (see also Frontispiece).

Larch Sawfly, **Pristiphora erichsonii** (Htg.)

In 1987 intensive surveys of tamarack (**Larix laricina** [Du Roi] K. Koch) stands failed to reveal any evidence of this sawfly in the region. Stands were monitored closely in 1988 and several colonies were recovered from Fauquier and Macvicar townships, Kapuskasing District. Curled shoots with egg slits and a few branches showing light defoliation were observed at one location in Thorneloe Township, Timmins District but no sawflies were found here or in other districts of the region.

Table 6. Summary of leader damage in jack pine plantations in two townships of Gogama District, 1987-1988 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Year	White pine weevil	Eastern pine shoot borer	Jack pine tip beetle	Unknown
Invergarry	1987	8.0	3.6	1.4	4.5
	1988	3.6	5.5	0.8	9.4
Vrooman	1987	4.4	0.9	0.2	2.8
	1988	1.1	0.9	0.4	3.3

Table 7. Summary of damage caused by the white pine weevil in four districts of the region in 1987 and 1988 (counts based on the examination of 150 randomly selected jack pine trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Leaders killed (%) 1987	1988
Chapleau District					
Marshall	2.4	1500	25	10.7	6.0
Island Lake TIA	1.3	2500	20	10.7	8.0
Copperfield	2.2	1500	68	0.7	2.7
Hutcheon	1.8	1600	10	14.7	4.7
De Gaulle	1.8	2500	10	-	2.0
Langlois	2.1	2500	15	20.0	3.3
Caverly	2.1	2500	50	-	8.0
Dalmas	2.3	1500	25	19.3	16.0
McNaught	1.4	1500	50	-	11.3
Esther	2.4	1500	10	-	2.7
Edith	3.1	1500	25	-	4.7
Gogama District					
Sheard	2.2	2500	200	22.3	15.7
MacMurchy	1.5	1500	20	-	2.7
Benneveis	2.7	1500	10	-	4.7
Timmins District					
Macklem	1.8	3500	50	12.6	9.3
Kenogaming	3.5	3500	50	-	5.3
Carscallen	2.5	4000	50	-	9.3
Kirkland Lake District					
Holmes	2.8	4000	50	-	20.6
Charters	1.0	4000	50	-	31.3
Chown	0.8	4000	50	-	21.3
Gross	2.1	4000	50	20.6	14.0
Arnold	0.6	4000	50	-	6.6

Mountain-ash Sawfly, **Pristiphora geniculata** (Htg.)

Populations of this sawfly remained relatively low throughout the region. In the town of Chapleau defoliation of ornamental trees did not exceed 30%. Heavier damage was recorded at Ivanhoe Provincial Park, where defoliation of mountain-ash (**Sorbus americana** Marsh.) trees averaged 60% (see photo page). In Battersby Township, Gogama District, 20% of the trees examined sustained foliar damage of 30% but in all other districts the sawfly was rarely found and little damage to either urban or forest trees was observed.

Early Aspen Leafcurler, **Pseudexentera oregonana** (Wlsm.)

High numbers of this leafroller recurred at several locations in the Hearst District in the northwestern part of the region (Fig. 4). Moderate-to-severe defoliation of mature trembling aspen stands over a total of 7,500 ha was mapped along the Kabinakagami, Nagagami and Kenogami rivers in the northern part of the district and along the Ridge P ver east of Indian Reserve #66 (see photo page). Smaller areas of similar damage occurred on scattered aspen stands in Township 238 and Rogers Township. No damage by the insect was reported from other districts of the region.

Grey Willow Leaf Beetle, **Pyrrhalta decora decora** (Say)

This insect has been reported in epidemic numbers on willow (**Salix** spp.) and poplar in Newfoundland, western Ontario and the prairie provinces. The tiny adult beetles emerge from hibernation in late May or early June and feed on willow and poplar. After mating, the females lay eggs at the bases of willow bushes. After hatching the larvae move up to feed on the underside of leaves, which they then skeletonize. Larvae complete their feeding about mid-August in Ontario, drop to the soil and pupate. The adults emerge in about seven days and feed on willow and poplar before seeking hibernation sites in protected places.

In 1988, severe skeletonizing of hundreds of hectares of willow throughout Chapleau, Gogama, Kirkland Lake and Timmins districts precipitated numerous inquiries from concerned property owners. In late August light-to-moderate defoliation of trembling aspen was caused by adult feeding at many locations in Kirkland Lake District.

Minor Insects

Jack Pine Tip Beetle, **Conophthorus banksianae** McP.

These beetles bore into the tips of jack pine twigs in May and leave a characteristic pitch-encrusted entrance hole. In early June egg

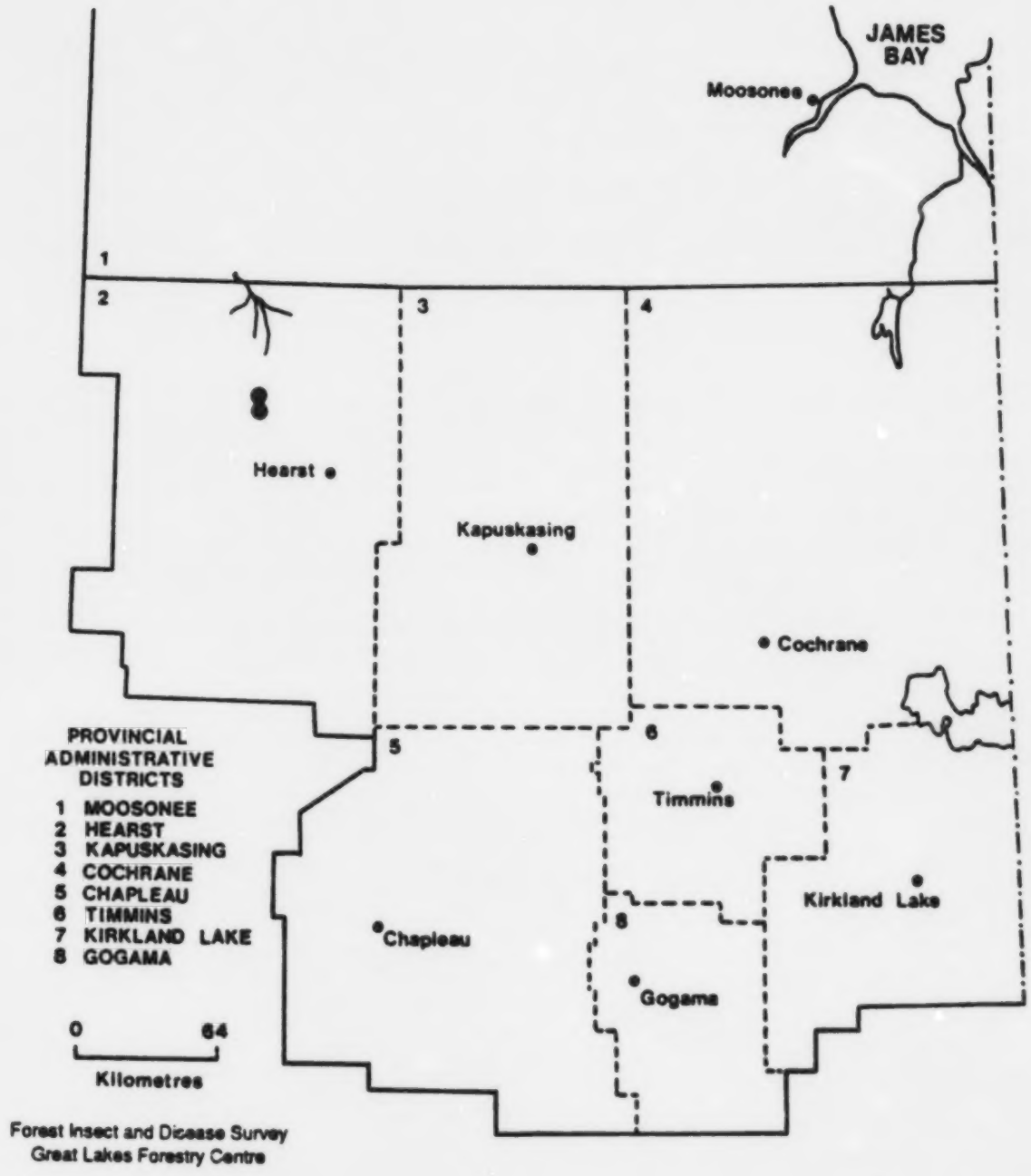


Figure 4. Early aspen leafcurler (*Pseudexentera oregonana* [Wlsm.]).

Areas within which defoliation of trembling aspen occurred in 1988 ●

tunnels constructed by the females cause the new growth to wilt and die (see photo page). Widely distributed through jack pine plantations in the region, the principal damage occurs when the leaders of young trees are destroyed, causing malformation of the main stem (Table 8).

Table 8. Summary of leader damage by the jack pine tip beetle in two districts of the region in 1988 (based on the examination of 150 randomly selected jack pine trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated area affected (m)	Trees attacked (%)	Leaders killed (%)
Chapleau District				
Hutcheon	1.6	25	50.0	3.0
Langlois	1.3	15	35.3	6.7
Gogama District				
Battersby	2.0	100	60.0	2.0
Invergarry	2.0	50	8.0	1.0

Table 9. Other forest insects.

Insect	Host(s)	Remarks
Aceria sp. nr. dispar (Nal.) Aspen leaf mite	tA	common throughout Timmins and Kirkland Lake districts; particularly conspicuous in stands with foliar damage by other insects
Acrobasis betulella Hlst. Birch tubemaker	wB	less than 5% defoliation in the majority of stands examined in Chapleau, Timmins and Kirkland Lake districts
Actebia fennica (Tausch.) Black army cutworm	-	21 and 31 adults captured on prescribed burn sites in Machin Twp, Kapuskasing District and in Arnott Twp, Hearst District, respectively

(cont'd)

Table 9. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Agromyza sp. nr. **alni betulae**	wB	about 2% leaf mining on semimature trees in Reeves Twp SPA, Chapleau District
Altica ambiens alni Harr. Alder flea beetle	Al	75% defoliation of alder (**Alnus** spp.) shrubs in Hill and Caouette twps, Chapleau District, in Greenwater Provincial Park, Cochrane District and in Munro, McCool and Michaud twps, Kirkland Lake District
Anacampsis niveopulvella (Chamb.) Paleheaded aspen leafroller	tA	less than 10% defoliation of single trees scattered throughout Chapleau and Kirkland Lake districts
Aphrophora cribrata (Wlk.) Pine spittlebug and **Aphrophora saratogensis** (Fitch) Saratoga spittlebug	jP	large numbers of spittle masses at many points in the southern part of the region; small numbers of nymphs found at Iroquois Falls, Cochrane District
Archips cerasivorana (Fitch) Uglynest caterpillar	Ch	numerous nests in the vicinity of Charlton, Englehart and New Liskeard, Kirkland Lake District; small numbers in Strathearn Twp, Chapleau District
Arge clavicornis (F.) Willow argid	Al	10% defoliation of roadside alder in Strathearn Twp, Chapleau District
Argyresthia laricella Kft. Larch shoot moth	tL	5% of branch tips killed on scattered trees in Calder Twp, Cochrane District
Campaea perlata (Gn.) Fringed looper	tA	5% defoliation of a semi-mature stand, Green Twp, Chapleau District

(cont'd)

Table 9. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Cecidomyia resinicola (O.S) Jack pine resin midge	jP	10-15% shoot mortality in scattered plantations in Chapleau and Kirkland Lake districts
Eupareophora parca (Cress.) Spiny ash sawfly	bAs	90% of stands in Chapleau and Gogama districts affected with about 30% defoliation; less than 5% defoliation in a few stands in Kirkland Lake District
Fenusa dohrnii (Tisch.) European alder leafminer	Al	about 10% foliage mined at several points in Holmes and Nordica twps, Kirkland Lake District
Gonioctena americana (Schaeff.) American aspen beetle	tA	90% defoliation of 2- to 3-m trees growing in jack pine plantations at several points in Chapleau District; low levels throughout Kirkland Lake District
Hyphantria cunea (Drury) Fall webworm	deciduous	5-10% defoliation of willow and alder trees at many points in the vicinity of Englehart, Tomstown, Hilliardton and Belle Vallee, Kirkland Lake District
Malacosoma californicum pluviale (Dyar) Northern tent caterpillar	deciduous	Populations increased markedly in Chapleau and Gogama districts. Tents were common along bush roads and in cut-over stands in Kirkland Lake District.
Petrova albicapitana (Bsk.) Northern pitch twig moth	jP	found in most stands examined, but incidence usually less than 3%, and little damage observed

(cont'd)

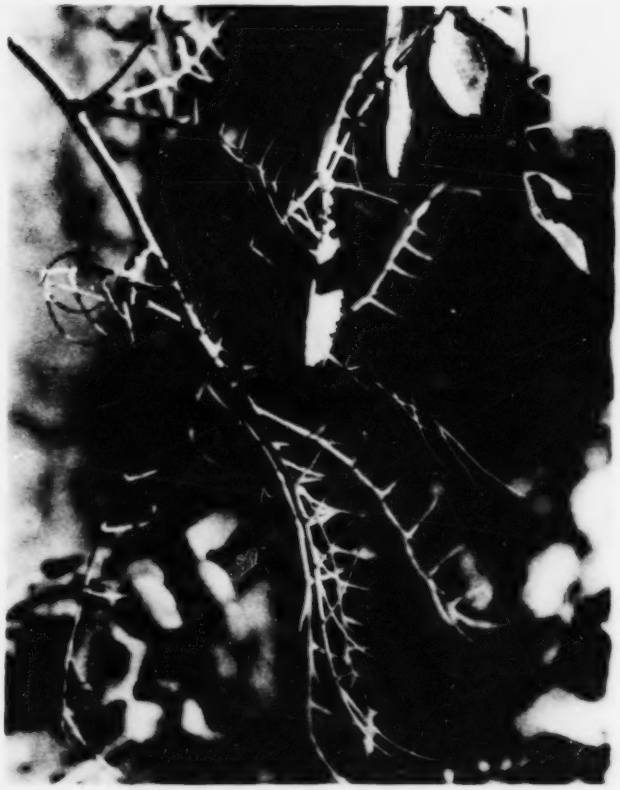
Table 9. Other forest insects (concl.).

Insect	Host(s)	Remarks
Phyllonorycter nipigon (Free.) Balsam poplar leafblotch miner	bPo	small pockets of severe mining (75%) at many points in Timmins and Kirkland Lake districts
Phyllonorycter ontario (Free.) Aspen leafblotch miner	tA	mining of up to 80% of foliage at many points in the region, but infested areas small
Pleroneura brunneicornis Roh. Balsam shootboring sawfly	bF	widespread but in lov numbers throughout Kirkland Lake and Timmins districts
Profenusa thomsonii (Konov) Ambermarked birch leafminer	vB	occasional mined leaves in Kirkland Lake and Timmins districts; usually less than 5% of the foliage affected
Proteoteras moffatiana Fern. Maple shoot borer	sM	less than 5% foliar damage to mature trees in a 2-ha stand in Deans Twp, Chapleau District
Rhabdophaga swainei Felt Spruce bud midge	bS	10-15% bud damage on open-growing trees, Dempsey Twp, Cochrane District
Tetralopha aplastella (Hlst.) Aspen webworm	tA	approximately 5% defoliation in most stands examined in Timmins and Kirkland Lake districts
Toumeyella parvicornis (Ckll.) Pine tortoise scale	jP	single trees and small groups of trees heavily infested at many points throughout the southern part of the region
Trichiocampus gregarius (Dyar) Hairy poplar sawfly	tA	approximately 10% defoliation of semimature trees at one point in Lloyd Twp, Chapleau District

Jack pine leader killed by jack pine tip beetle (*Conophthorus banksianae* McP.) (Note exit hole at base of shoot.)

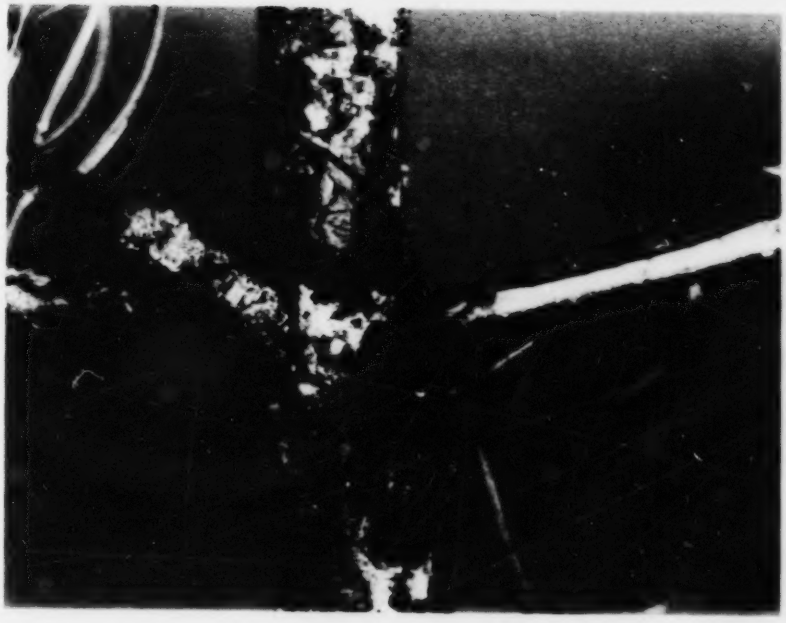
Young jack pine with leader broken by eastern pine shoot borer (*Eucosma gloriola* Heinr.)

Aerial photo of severe defoliation by early aspen leafroller (*Pseudexentera oregonana* [Wlsm.]) along Ridge River, Hearst District



Ornamental mountain ash defoliated by mountain-ash sawfly (*Pristiphora geniculata* [Htg.]) in Ivanhoe Provincial Park, Chapleau District, July 1988

Jack pine with bark stripped by whitespotted sawyer beetle (*Monochamus scutellatus* [Say]) in Delaney Twp, Chapleau District, June 1988



Adult sawyer beetles feeding on jack pine

Abiotic condition causing atrophic growth of white spruce shoots in 1988

Club top on jack pine caused by stem gall of western gall rust (*Endocronartium harknessii* [J.P. Moore] Y. Hirats.) (The gall has not yet begun to fruit.)

TREE DISEASES

Major Diseases

Armillaria Root Rot, **Armillaria mellea** (Vahl:Fr.) Kummer

As in previous years, trace levels of this root rot were found throughout the region. The majority of plantations surveyed contained this disease but mortality was not extensive. Damage levels in the sample plots listed in Table 10 are indicative of the levels found throughout the region.

Table 10. Summary of mortality caused by Armillaria root rot on jack pine in four districts of the region in 1988 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees/ha	Area affected (ha)	Current mortality (%)
Cochrane District				
Freele Twp	1.8	1,600	3	0.7
Gogama District				
Invergarry	1.0	1,600	10	0.7
Kirkland Lake District				
Morrisette	1.2	3,800	15	1.9
Pense	0.9	4,000	6	0.7
Catherine	1.3	3,500	3	2.0
Corkill	0.8	3,500	5	1.9
Arnold	0.8	3,500	10	0.7
Timmins District				
Macklem	0.7	3,300	3	2.6

Scleroderris Canker, **Ascocalyx abietina** (Lagerb.) Schläpfer-Bernhard

Surveys were conducted in red pine (**Pinus resinosa** Ait.) and jack pine plantations throughout the region to locate the presence of Scleroderris canker. Surveys revealed trace levels of the disease in Chapleau, Gogama, Kirkland Lake and Timmins districts. These results were consistent with the previous year's results, an indication of either no increase or a decrease in the incidence of this disease.

There are two races of this disease, the native and the European. The European race is much more serious, as it can kill trees of all sizes, and in one season. The native race kills only trees that are less than 2 m high. All samples of Scleroderris canker found were submitted to the Disease Survey staff at the Great Lakes Forestry Centre for race identification. All tests for the European race were negative in 1988.

Pine Needle Rust, **Coleosporium asterum** (Dietel) Sydow

In 1988, the incidence of this foliage disease of jack pine increased throughout the entire region. Light damage was common in the majority of plantations throughout the southern portion of the region (Table 11). Severe damage was found in several areas, the heaviest occurring in Reaney Township, Chapleau District, where 100% of the trees were affected and there was an average of 66% foliar damage. This disease causes the premature loss of the previous year's foliage. Light damage has little impact on the tree. However, severe infection can kill small trees and cause a reduction in growth of trees of sapling size.

White Pine Blister Rust, **Cronartium ribicola** J.C. Fisher

This disease is common on mature white pine (**Pinus strobus** L.) in the southern part of the region. Trees with tops killed by blister rust are a common sight when one is traveling through some districts. It is difficult to assess damage to mature trees because they are so widely scattered, but a reasonable estimate would be that 15% of the trees are affected.

In Chapleau District, recently planted trees were affected in four townships (Table 12). In all cases, the trees were severely infected, with the infection having reached the stem. This infection will eventually kill the trees. In the areas evaluated, it was not possible to do a normal 150-tree survey; therefore, a 100% evaluation was completed.

Tar Spot Needle Cast, **Davisomycella ampla** (J. Davis) Darker

Occurrence of this early-season foliage disease of jack pine was generally low throughout the region. Needle cast causes the previous year's foliage to discolor and to fall off prematurely. In years of heavy defoliation, trees are significantly weakened and show a reduction in growth. Although damage was generally light in most of the region, a few pockets of moderate infection were surveyed (Table 13).

Table 11. Summary of damage caused by needle rust of jack pine in four districts of the region in 1988 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Foliar damage (%)
Chapleau District					
Copperfield	0.4	4,444	100	75	5
Reaney	0.3	4,444	25	100	66
Marshall	1.5	2,500	30	99	12
D'Arcy	1.3	2,500	60	100	22
Chappise	2.1	1,600	10	60	10
Nimitz	1.0	2,500	134	13	6
Smuts	0.4	4,444	30	100	15
Warren	1.0	2,500	10	100	33
Gogama District					
Garibaldi	1.2	2,500	50	100	15
Invergarry	0.5	2,500	60	75	10
MacMurchy	1.5	2,500	25	100	22
Hearst District					
Cross	3.5	2,200	220	100	5
Larkin	0.8	4,500	5	100	5
Kirkland Lake District					
Tyrell	1.7	2,800	5	90	15
Ingram	7.0	2,500	10	3	2
Arnold	0.8	4,444	10	3	1

Table 12. Summary of damage caused by white pine blister rust in Chapleau District in 1988.

Location (Twp)	Avg ht (m)	No. of trees examined	No. of trees affected	Trees affected (%)
Gilliland	0.8	60	3	5
Kosny	0.7	25	4	16
Green	1.0	25	1	4
Neill	0.8	22	6	27

Table 13. Summary of damage caused by needle cast of jack pine in four districts of the region in 1988 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Defoliation level (%)
Chapleau District					
Nimitz	1.0	2,500	134	40.7	12
DeGaulle	1.5	2,500	10	51.3	10
Hutcheon	1.6	2,500	20	21.3	6
Chappise	2.1	2,500	23	23.3	13
Neelands	1.2	2,500	5	42.0	7
Gogama District					
Invergarry	1.0	2,500	5	24.7	11
Garibaldi	1.5	2,500	50	40.0	5
Kirkland Lake District					
Tyrell	3.0	4,500	100	1.0	10
Cane	8.0	3,500	50	7.0	10
Ingram	6.0	3,500	10	6.0	10
Gauthier	5.0	2,500	2	2.0	10
Gross	2.0	3,500	50	5.0	10
Beauchamp	6.0	2,000	50	2.0	10
Timmins District					
Robb	3.0	4,500	100	26.0	10

Western Gall Rust, **Endocronartium harknessii** (J.P. Moore) Y. Hirats.

Areas with high infection levels in 1987 were again surveyed in 1988 in Chapleau, Gogama and Kirkland Lake districts (Table 14), and several new areas of severe infection of jack pine were evaluated. As the galls are located on the stem, many of the infected trees will probably die eventually. Stem galls cause abnormal growth of young trees (see photo page), affecting their form.

Infected trees at Island Lake TIA were pulled out in 1987 in a control operation that proved to be very successful. In 1987, 18% of the trees were severely infested with stem galls. After the control operation, fewer than 1% of the trees were infected.

Table 14. Summary of damage by western gall rust in four districts of the region in 1988 (counts based on the examination of 150 jack pine trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no of trees per ha	Estimated no. of ha infected	Trees affected (%)	Trees affected severely (%)
Chapleau District					
Neelands	1.2	4,444	5	37.3	27.3
DeGaulle	1.5	2,500	10	39.3	19.3
Caverly	0.4	4,444	5	30.7	29.3
Chappise	2.2	2,500	25	12.7	0
Copperfield-south	0.5	2,500	5	14.0	14.0
Copperfield-north	0.4	4,444	100	35.3	35.3
Hutcheon	1.6	2,500	20	12.7	4.7
Nimitz	1.0	2,500	135	10.7	6.7
Reaney	1.0	2,500	30	2.0	2.0
Gogama District					
MacMurchy	2.0	2,500	40	8.0	8.0
Invergarry	1.0	2,500	15	9.0	7.6
Kirkland Lake District					
Morrisette	1.0	4,500	50	0.6	0
Gauthier	5.0	2,500	2	1.3	0
Gross	2.0	3,500	50	0.6	0
Ben Nevis	1.0	4,500	10	32.6	32.6
Timmins District					
Robb	3.0	4,500	100	3.3	0.6
Thornloe	4.0	2,500	4	1.3	0
Sevell	4.0	2,500	2	3.3	0
German	4.0	1,500	2	0.6	0

Table 15. Other forest diseases.

Organism	Host(s)	Remarks
Blumeriella jaapii (Rehm) v. Arx Shot-hole	Ch	80-90% foliar discoloration common on shrubs near the town of Chapleau, Chapleau District
Chrysomyxa ledi (Alb. & Schvein) de Bary var. **ledi** Spruce needle rust	bS	1-2% foliar damage in many areas in the region

(cont'd)

Table 15. Other forest diseases (cont'd).

Organism	Host(s)	Remarks
Chrysomyxa pirolata (Körn.) Winter Spruce cone rust	wS	1-2% of the cones damaged on a few scattered trees at Opasatika TIA, Kapuskasing District
Ciborinia whetzelii (Seaver) Seaver Ink spot of aspen	tA	10% foliar damage to young roadside aspen in Lloyd Twp, Chapleau District; 25% foliar damage to 100% semimature trees in a 0.5-ha clearing in Hellyer Twp, Chapleau District
Cladosporium aecidiicola Thüm.	bS	parasite of needle rust found on small scattered plantings in Abbott Twp, Kapuskasing District
Isthmiella faullii (Darker) Darker Needle cast	bF	10-15% loss of old foliage at scattered locations in central Chapleau District
Leucostoma nivea (Hoffm.:Fr.) Höhnel Cytospora canker	hybrid poplar	a few dead trees at Svastika Tree Nursery, Kirkland Lake District
Linospora tetraspora G.E. Thompson Linospora leaf blight	bPo	pockets of 75-80% foliar damage throughout the northern part of the region
Lophodermella concolor (Dean) Darker Needle cast	jP	90% foliar damage to individual trees in Kipling Twp, Kapuskasing District and in Corkill Twp, Kirkland Lake District
Lophodermium sp. Needle cast	jP	1-2% defoliation common in Island Lake TIA, Chapleau District
Melampsora medusae Thüm. Larch-poplar rust	hybrid poplar	75% of foliage damaged in a compartment of hybrid poplar, Bonner Centre, Kapuskasing District
Melampsora sp. Willow rust	W	100% of leaves infected on bushes in Shoals Prov. Pk, Chapleau District

(cont'd)

Table 15. Other forest diseases (concl.).

Organisms	Host(s)	Remarks
Sphaeropsis sapinea (Fr.) Dyko & B. Sutton Tip blight	jP	several trees with stem cankers in Ben Nevis Twp, Kirkland Lake District
Uredinopsis sp. Needle rust	bF	100% of examined regeneration trees less than 1.5 m tall infected in Wakami Prov. Pk, Chapleau District, with an average of 25% defoliation
Valsa friesii (Duby) Fuckel Dieback	bF	scattered 1-m trees with branch mortality in Dublin Tp, Gogama District
Valsa sordida Nitschke Cytospora canker	tA	one tree killed in Chovn Twp, Kirkland Lake District
Venturia macularis (Fr.) E. Müller & v. Arx Shoot blight	tA	widely distributed in aspen regeneration throughout the region, but damage generally insignificant

ABIOTIC DAMAGE

Atrophic Growth on Spruce

There was a high incidence of bud failure on young white spruce and black spruce in northern Chapleau District and central Hearst, Kapuskasing and Cochrane districts (Fig. 5). Most severely affected were plantations of open-growing 1- to 3-m trees, on which up to 100% of the buds were affected in the top and mid-crown sections (see photo page). However, below the 60- to 70-cm level, shoot development was normal. It is interesting to note that this damage was random, with one tree affected and a tree 1 m away unaffected. In most plantations surveyed, roughly two thirds of the trees were affected (Table 16). The reason for this damage is undetermined, but the likely cause was unusual weather during the winter of 1987-1988.

Table 16. Summary of abiotic damage to spruce in Chapleau and Hearst districts in 1988.

Location (Twp)	Host[a]	Avg ht (m)	Trees affected (%)
Chapleau District			
Gilliland	wS	1.2	75
Lipsett	wS	1.6	60
Panet	wS	1.0	70
Kapuskasing District			
Bonner Centre	bS	2.3	65

[a] wS = white spruce, bS = black spruce

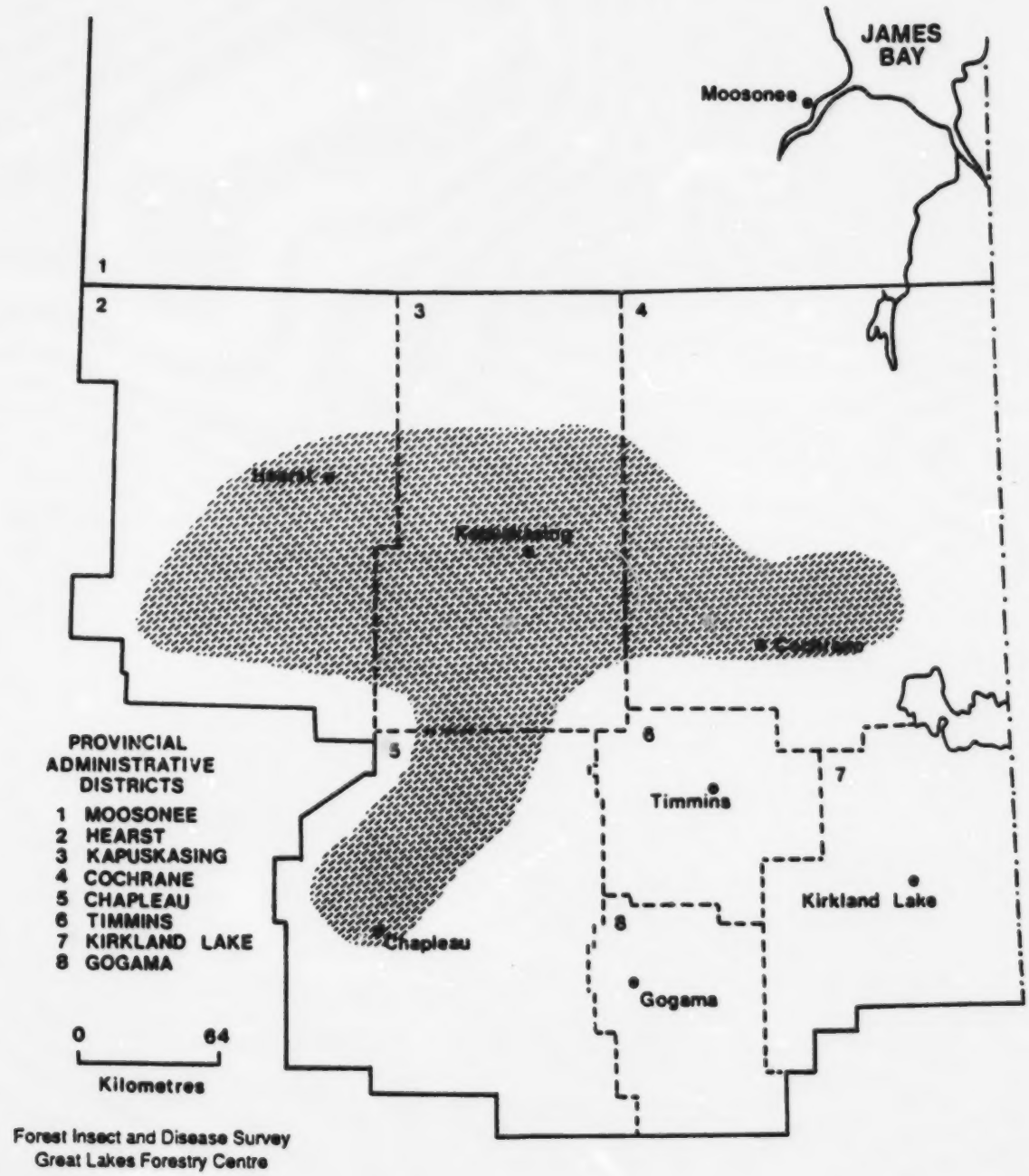


Figure 5. Atrophic growth on white spruce and black spruce in 1988.

Area within which atrophic growth occurred

Jack Pine Plantations

A special survey was conducted to assess the impact of insect and disease problems in 18 jack pine plantations in the region (Table 17). Stand selection was from three height classes: 0.5-2 m, 2-6 m, and >6 m. Six of the areas examined in the current survey were the 300-tree semipermanent plots established in 1982. Each of the other 12 stands of jack pine consisted of a 150-tree sample. Two visits were made to each plot during the periods 6-24 June and 1-31 August. The stands were checked for the presence of the following insects and diseases (Tables 17a, 17b).

Insects: jack pine budvorm, white pine weevil, eastern pine shoot borer, jack pine tip beetle, jack pine sawflies and Swaine jack pine sawfly.

Diseases: Armillaria root rot, stem rusts, western gall rust, pine needle rust, tar spot needle cast.

Insects not found in the current survey included jack pine budvorm and jack pine sawflies.

Moderate-to-severe damage by white pine weevil was noted in four plantations in the survey. Low levels of eastern pine shoot borer, jack pine tip beetle, and Swaine jack pine sawfly were also observed at various locations.

Light-to-moderate levels of the foliar diseases pine needle rust and tar spot needle cast were observed in approximately two-thirds of the plantations. Western gall rust, which has become a problem in the region, was found in six areas. The most damage from gall rust was found in Ben Nevis Twp, Kirkland Lake District, where 32.6% of the trees were severely affected. Trace levels of Armillaria root rot were found in three plantations.

Table 17a. Summary of the results of a special survey of 18 jack pine plantations or high-value stands in the region in 1988 (counts based on the examination of 150 or 300 randomly selected trees at each location).

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Height class (m)	Jack pine budworm		White pine weevil	Eastern pine shoot borer		Jack pine tip beetle	Swaine jack pine sawfly	
				Trees affected (%)	Defoliation (%)	Trees affected (%)	Leaders attacked (%)	Laterals attacked (%)	Leaders attacked (%)	Trees affected (%)	Defoliation (%)
Chapleau District											
Nimitz	134	2,500	<2 m	0	0	14.7	2	2	0	0	0
Edith	40	1,500	>6 m	0	0	0	0	0	0	0	0
Bliss[a]	75	2,500	2.0–6.0 m	0	0	0.3	3.0	0	0	0	0
Gilliland[a]	20	2,500	2.0–6.0 m	0	0	1.3	4.3	0	0	0	0
Gogama District											
Invergarry	10	2,500	<2 m	0	0	9.3	1.3	0	0	0	0
Vrooman	10	2,500	>6 m	0	0	0	0.6	1.2	0	0	0
Kirkland Lake District											
Cane	10	2,500	>6 m	0	0	1.3	0	0	0.7	0.7	2
Ingram	10	2,500	>6 m	0	0	0.7	0	0	2.7	0	0
Arnold	10	2,500	<2 m	0	0	6.7	0.7	2.0	0.7	0	0
Ben Nevis	10	2,500	<2 m	0	0	0.7	0.7	0	0	0	0
Gross[a]	15	2,500	2.0–6.0 m	0	0	14.0	3.3	4.0	4.0	0	0
Timmins District											
Robb[a]	50	2,500	2.0–6.0 m	0	0	0.7	3.3	0	0	0	0
Cochrane District											
Freele	3	1,600	<2 m	0	0	0.7	0	0	0	0	0
Sheldon[a]	93	1,600	2.0–6.0 m	0	0	0	0	0	0	0	0
Dempsey	10	1,600	>6 m	0	0	0	0	0	0	0	0
Hearst District											
Cross[a]	220	2,500	2.0–6.0 m	0	0	0	0	0	0	0	0
Larkin	5	2,500	<2 m	0	0	0	0	0	0	0	0
Kapuskasing District											
Fauquier	3	1,500	>6 m	0	0	0	0	0	0	0	0

[a] 300-tree sample

Table 17b. Summary of the results of a special survey of 18 jack pine plantations or high-value stands in the region in 1988 (counts based on the examination of 150 or 300 randomly selected trees at each location).

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Height class (m)	Armillaria root rot	Stem rusts		Western gall rust		Pine needle rust	Tar spot needle cast
				Trees affected (%)	Trees affected (%)	Trees severely affected (%)	Trees affected (%)	Trees severely affected (%)	Avg foliar damage (%)	Avg foliar damage (%)
Chapleau District										
Nimitz	134	2,500	<2 m	0	0	0	8	5.3	6.5	15
Edith	40	1,500	>6 m	0	0	0	14	1.3	0	2.7
Bliss[a]	75	2,500	2.0–6.0 m	0	0	0	0	0	8.7	9.3
Gilliland[a]	20	2,500	2.0–6.0 m	0	0	0	0	0	0	0
Gogama District										
Invergarry	10	2,500	<2 m	0.7	0	0	8.9	7.6	2.0	10.5
Vrooman	10	2,500	>6 m	0	0	0	24.0	0	6.5	6.5
Kirkland Lake District										
Cane	10	2,500	>6 m	0	0	0	0	0	0	12.0
Ingram	10	2,500	>6 m	0	0	0	0	0	2.0	5.0
Arnold	10	2,500	<2 m	0.7	0	0	0	0	1.0	0
Ben Nevis	10	2,500	<2 m	0	0	1.3	32.6	32.6	0	0
Gross[a]	10	2,500	2.0–6.0 m	0	0	0	0	0	0	5.0
Timmins District										
Robb[a]	50	2,500	2.0–6.0 m	0	0	0	0	0	0	0
Cochrane District										
Freele	3	1,600	<2.0 m	0.7	0	0	4.0	2.7	0	16.0
Sheldon[a]	93	1,600	2.0–6.0 m	0	0	0	0	0	0	0
Dempsey	10	1,600	>6.0 m	0	0	0	0	0	0	0
Hearst District										
Cross[a]	220	2,500	2.0–6.0 m	0	0	0	0	0	5	0.3
Larkin	5	2,500	<2 m	0	0	0	0	0	5	0
Kapuskasing District										
Fauquier	3	1,500	>6 m	0	0	0	0	0	0	0

[a] 300-tree sample

Surveys of Nurseries

There are three provincial tree nurseries located in the region: one each in Chapleau, Gogama and Kirkland Lake districts. Contacts were maintained with nursery personnel, and surveys were conducted on a weekly or biweekly basis. Rangers were available if a problem arose that needed immediate attention.

At the Chapleau Nursery fewer than 1% of the black spruce planted in the spring of 1987 were affected with **Cylindrocladium floridanum** Sob. & C.P. Seym. This disease caused some mortality but, because of its low levels, it was not considered a problem. One jack pine seedling had its leader attacked by jack pine tip beetle, but again, because damage was minimal, it was not a problem.

Mature jack pine just outside the Gogama nursery are heavily infected with western gall rust. This gall rust may become a problem as it is possible for it to be transferred to jack pine seedlings. The infection will not become evident until the trees have been transplanted, as the fruiting does not appear until three or four years after infection. In addition, 1-2% of young white spruce in a seed orchard have been killed by armillaria root rot in the past couple of years.

At Swastika Nursery most damage was found on windbreak trees and in plantations. In jack pine plantations, white pine weevil and jack pine tip beetle were commonly found. Also found at low levels were tar spot needle cast and jack pine resin midge (**Cecidomyia resinicola** [O.S.]). Low levels of white pine blister rust were found scattered in the nursery. Trembling aspen trees growing in the nursery were infected with ink spot of aspen and shoot blight. As was the case throughout the region, severe defoliation of aspen and willow was caused by gray willow leaf beetle. Finally, two other pests, **Nycteola cinereana** N. & D. and **Lepyrus alternans** Casey, were found at low levels under container stock.

Gypsy Moth Pheromone Traps

Pheromone traps were set out in the 12 provincial parks and one private park in the region to detect the presence of gypsy moth (**Lymantria dispar** [L.]). Ten traps were hung in each park in which positive catches had been made in 1987, viz., Fushimi Provincial Park, Hearst District, and Kettle Lakes Provincial Park, Timmins District. Two traps were deployed in each of the remaining parks. In 1988, male adult moths were caught in Esker Lakes Provincial Park and Kap-kig-i-wan Provincial Park, Kirkland Lake District. All other results were negative.

Acid Rain National Early Warning System

As in previous years, the three study plots established in 1984 and 1985 were resampled in 1988. All the trees on the 400 m^2 plots were examined and any damage was recorded. Ground-cover plants were examined and compared with those collected in previous years. No damage was observed in any plot except for low levels of tar spot needle cast and western gall rust in the plot in Deans Township, Chapleau District.

Aerial photos are taken annually to detect any changes to the stand.

Jack Pine Seed and Cone Pests

Two areas were sampled to assess the types of insects and diseases present and their impact on cone and seed crops (Table 18). One hundred 2-year-old cones from a minimum of three trees representing the total length of the cone-bearing crown were collected during the first week of July. The sample was forwarded to the Great Lakes Forestry Centre for dissection and analysis. Damage found in 1988 was generally low and insignificant.

Table 18. Summary of jack pine seed and cone damage at two locations in the region in 1988.

Location (Twp)	No. of cones examined	Damaged cones (%)	Seed loss within damaged cones (%)	Principal cause of seed loss (in order of importance)
Chapleau District				
Hong Kong	100	6	1.4	Lepidoptera **Resseliella** sp.
Hearst District				
Cross	100	7	2.9	Unknown **Resseliella** sp.

Pinewood Nematode, **Bursaphelenchus xylophilus** (Steiner & Bührer) Nickle

As a result of sampling conducted in recent years it has been determined that this pest is present throughout the region on dead and dying jack pine. Therefore, work in 1988 was concentrated in other areas. Balsam fir (**Abies balsamea** [L.] Mill.) and spruce were sampled to determine if the "r" or "m" form of this pest was present (Fig. 6). Also, trees in known infection centers trees were marked as either dead or alive. The purpose of these designations was to determine if damage is spreading and, if it is, to document the rate of spread.

Work is also under way to determine possible vectors of the nematode. Fourteen samples of sawyer beetles and 21 samples of bark beetles were collected to determine if they were carrying the nematode (Fig. 7). These samples were submitted to experts at Memorial University in Newfoundland for analysis, but the results are not yet available.

Climatic Data

Weather records for three stations, those at the Kapuskasing, Earlton and Chapleau airports, have been included in this report (Table 19). Weather plays an important part in insect development and the spread of infectious diseases, and is the cause of many non-infectious conditions such as frost and hail damage, winter drying and drought.

Table 19. Summary of mean temperature and total precipitation at three locations in the region in 1988.

Month	Mean temp. 1988 (°C)	Normal temp. (°C)	Deviation from norm temp. (°C)	Total precip. (mm)	Normal precip. (mm)	Deviation from norm precip. (mm)
			Earlton			
Jan.	-15.2	-16.3	+1.1	60.7	56.4	+4.3
Feb.	-16.6	-14.1	-2.5	77.1	47.2	+29.9
Mar.	-8.0	-7.6	-0.4	50.5	58.0	-7.5
Apr.	2.3	1.9	+0.4	110.5	50.0	+60.5
May	11.8	9.8	+2.0	63.4	61.3	+2.1
June	14.6	15.2	-0.6	60.3	89.2	-28.9
July	19.8	17.7	+2.1	34.6	80.8	-46.2
Aug.	17.6	16.2	+1.4	165.5	83.4	+82.1
Sept.	11.5	11.1	+0.4	66.3	99.1	-32.8
Oct.	3.6	5.4	-1.8	65.4	70.0	-4.6
Nov.	-0.4	-2.5	+2.1	84.6	70.6	+14.0
Dec.	-13.7	-12.6	-1.1	49.9	65.3	-15.4

(cont'd)

Table 19. Summary of mean temperature and total precipitation at three locations in the region in 1988 (concl.).

Month	Mean temp. 1988 (°C)	Normal temp. (°C)	Deviation from norm temp. (°C)	Total precip. (mm)	Normal precip. (mm)	Deviation from norm precip. (mm)
			Chapleau			
Jan.	-16.1	-16.9	+0.8	76.2	46.9	+29.3
Feb.	-16.3	-15.8	-0.5	43.8	34.5	+9.3
Mar.	-8.3	-8.6	+0.3	68.6	56.2	+12.4
Apr.	2.5	0.6	+1.9	4.8	59.3	-51.5
May	11.1	8.6	+2.5	57.4	73.8	-16.4
June	14.8	14.3	+0.2	57.8	100.4	-42.6
July	19.1	16.8	+2.3	41.6	81.8	-40.2
Aug.	16.8	15.4	+1.4	170.0	86.2	+83.8
Sept.	11.0	10.4	+0.6	79.6	101.5	+21.9
Oct.	*	4.9		*	75.7	
Nov.	*	-3.5		*	64.2	
Dec.	*	-12.8		*	53.5	
			Kapuskasing			
Jan.	-18.7	-18.6	-0.1	57.7	53.6	+4.1
Feb.	-19.1	-16.2	-2.9	55.2	43.0	+12.2
Mar.	-10.3	-9.4	-0.9	74.2	55.4	+18.8
Apr.	1.4	0.5	+0.9	42.8	53.2	-10.4
May	10.2	8.3	+1.9	69.8	74.3	-4.5
June	13.0	14.1	-1.1	82.0	84.7	-2.7
July	19.0	16.8	+2.2	57.6	96.3	-38.7
Aug.	15.7	15.3	+0.4	179.2	92.5	+86.7
Sept.	10.6	10.0	+0.6	85.5	94.4	-8.9
Oct.	2.3	4.4	-2.1	60.9	77.4	-16.5
Nov.	-2.4	-4.4	+2.0	127.1	80.1	+47.0
Dec.	-16.4	-14.7	-1.7	61.6	53.3	+8.3

* Data not available at the time of publication

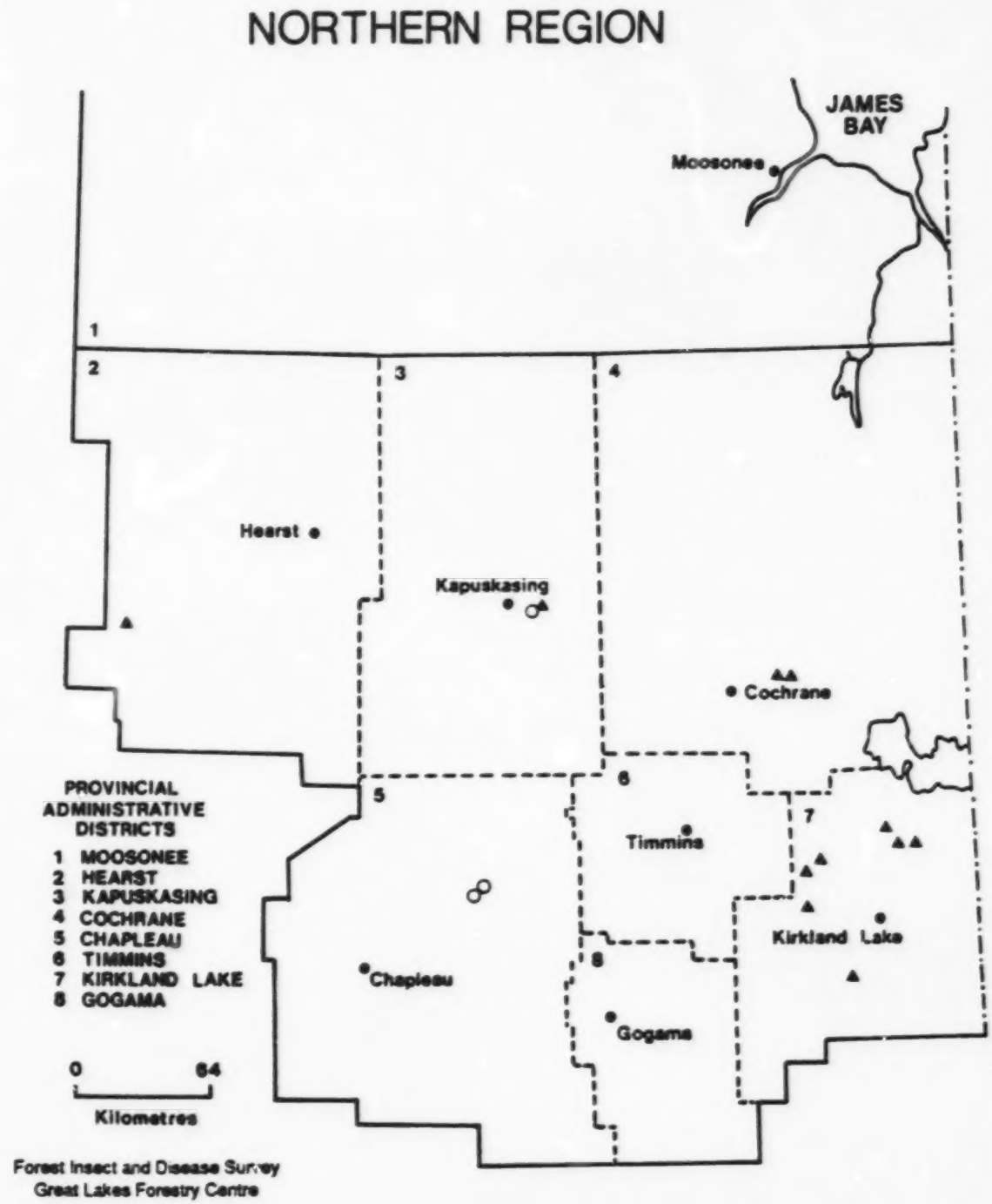


Figure 6. Pinewood nematode (*Bursaphelenchus xylophilus* [Steiner and Bührer] survey. Areas sampled in 1988:

jack pine ▲

balsam fir ○

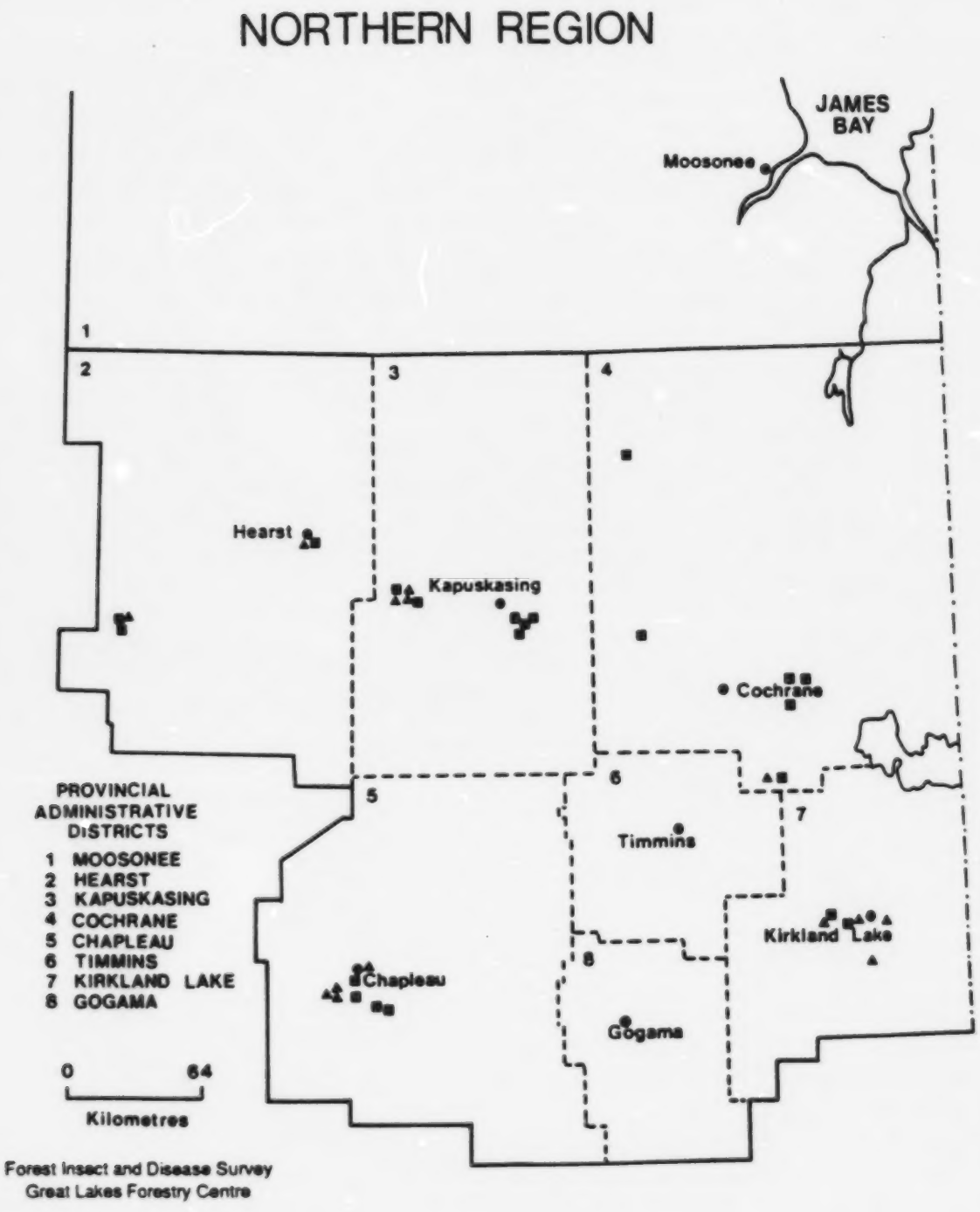


Figure 7. Pinewood nematode (*Bursaphelenchus xylophilus* [Steiner and Buhrer] Nickle) vector survey, 1988.

Locations sampled: *Monochamus* spp. ▲

bark beetles ■